High-Resolution Gamma-Ray Detection Using Phonon-Mediated Detection

Completed Technology Project (2011 - 2016)

Project Introduction

The recent breakthroughs in hard X-ray/soft gamma-ray optics, as characterized by the NuSTAR (2011 launch) and NEXT (2013 launch) missions, have finally opened up the 10- 100 keV band to detailed astronomical observation. Nuclear spectroscopic techniques at these energies allow for further study of the dynamics of supernovae, a poorly understood phenomenon of great scientific relevance. Such a study would require an energy resolution of roughly 100 eV at 70 keV or 0.1%. The current state-of-the art in focal plane detectors, such as the CdZnTe detectors on NuSTAR, have a FWHM resolution of around 1 keV at 70 keV. I propose to develop new type of focal plane to recover this order of magnitude in sensitivity. The device will be an athermal phonon-mediated detector that uses the microwave kinetic inductance detector (MKID) technology currently being developed by JPL (Rick LeDuc, Peter Day, and Bruce Bumble) and Caltech (Jonas Zmuidzinas and Sunil Golwala). It will use a 2 mm thick Ge substrate to stop the gammas, and convert their energy to athermal phonons. These phonons travel in straight lines, preserving information about the interaction point. They would then be detected by MKIDS deposited on the surface of the substrate. We have fabricated a proof-of-concept, which has demonstrated an energy resolution of sigma = 1.16 keV at 30 keV.

Anticipated Benefits

This project aims to develop a new type of focal plane that would potentially allow further study of the dynamics of supernovae, a poorly understood phenomenon of great scientific relevance. Such a study would require an order of magnitude increase in sensitivity over state of the art.

Project Image High-Resolution Gamma-Ray Detection Using Phonon-Mediated Detection

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

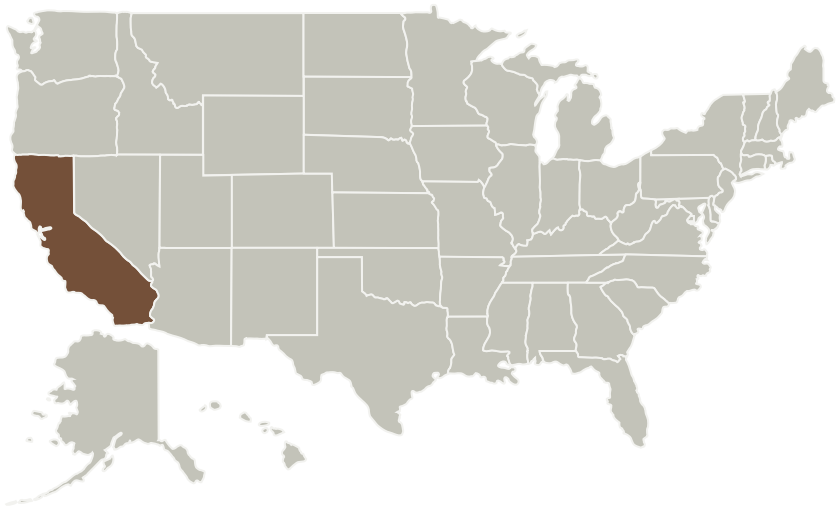
Responsible Program:

Space Technology Research Grants

High-Resolution Gamma-Ray Detection Using Phonon-Mediated Detection

Completed Technology Project (2011 - 2016)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations
California

Project Management

Program Director:
Claudia M Meyer

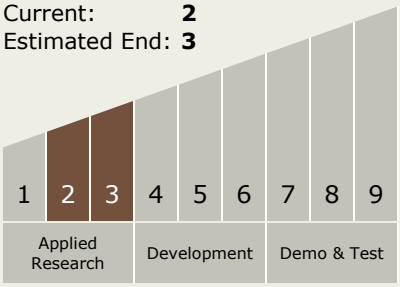
Program Manager:
Hung D Nguyen

Principal Investigator:
Sunil Golwala

Co-Investigator:
Brett D Cornell

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

High-Resolution Gamma-Ray Detection Using Phonon-Mediated Detection

Completed Technology Project (2011 - 2016)

Images

4245-1363185648482.jpg
Project Image High-Resolution Gamma-Ray Detection Using Phonon-Mediated Detection
(https://techport.nasa.gov/image/1774)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html